

UNITED STATES OF AMERICA

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DEPARTMENT OF COMMERCE

TECHNOLOGY ADMINISTRATION

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SUMMIT ON THE USE OF ADVANCED TECHNOLOGIES IN
EDUCATION AND TRAINING

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PLENARY SESSION

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FRIDAY, SEPTEMBER 27, 2002

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The summit came to order at 9:00 a.m. in room 4830 of the Department of Commerce, 14th Street and Constitution Ave, N.W., Washington, D.C., Phillip J. Bond, Under Secretary for Technology, presiding.

PRESENT:

Phillip J. Bond	U.S.
Department of Commerce	
John Bransford	Vanderbilt
University	
Karen Billings	Software and
Information	
	Industry Association
William Wiggenhorn	Cigna
Corporation	
Irving Wladawsky-Berger	IBM
Ralph E. Chatham	Defense
Advanced Research	
	Projects Agency
Ulrich Neumann	University of
Southern	

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I-N-D-E-X

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1 P-R-O-C-E-E-D-I-N-G-S

2 (8:59 a.m.)

3 MODERATOR BOND: Well, good morning. Let's
4 begin, shall we. For those of you I haven't had yet the
5 privilege to meet, my name is Phil Bond. I am privileged to
6 serve as the Under Secretary of Commerce for Technology.

7 I want to welcome you all here this morning for
8 joining us and for perhaps running a gauntlet or two to get
9 here. I was just watching the news upstairs, and they were
10 announcing that police had been called to the Commerce
11 Department.

12 (Laughter.)

13 MODERATOR BOND: I thought it had something to do
14 with you.

15 At any rate, I wanted to share just a couple of
16 framing thoughts this morning. Then we'll get to business
17 quickly. To state the obvious, technology is transforming every
18 industry and many human endeavors. For the most part, as I
19 think we all believe, our learning enterprises have been an
20 exception to this revolution. The way schools are organized,
21 how instruction is provided, and the tools available to teachers
22 and students have changed very little over perhaps as much as

1 even the last 100 years.

2 By contrast, of course, business has been forced
3 to manage technology and change in a strategic fashion. It has
4 been a core competency for American business. They plan. They
5 develop and manage rapid change being flexible for the future.
6 They rethink their business models, reengineer their processes,
7 reinvent their organizations, all to exploit the power of
8 technology and be competitive.

9 Education and training institutions have
10 historically been among the last to benefit from emerging
11 technologies. Often relying on tradition, they are slow to
12 adopt the new technologies and have little history with managing
13 innovation and rapid change.

14 For example, in many places around the country,
15 schools rely on discarded computer systems donated to them by
16 companies or government agencies, systems that are often several
17 generations out of date in this quickly cycling technological
18 world. And many schools simply apply technology on top of the
19 traditional teaching practice, rather than transforming the
20 teaching practice.

21 Sad but true, often the most technology-savvy
22 individuals in our learning institutions are those who wire the

1 computers and networks, rather than putting the technology to
2 use. As the current generation of technology in our learning
3 enterprise matures, it's now time to question our traditional
4 assumptions, stretch our collective minds about the future of
5 education and training in America. As we do that, a golden
6 opportunity is before us, is before you.

7 New technologies under development by U.S.
8 businesses and universities and government obviously could
9 transform learning in ways that we can't fully imagine.

10 Just last week, we released the *2020 Visions*
11 report that I am sure most of you have seen. It describes the
12 kinds of learning environments that are now visible just over
13 the horizon. However, there are many challenges.

14 For example, if you look around the room, many of
15 you are meeting each other for the first time. What you see may
16 appear to be on the surface a rather eclectic group. We have IT
17 companies, software and book publishers, organizational change
18 experts. The U.S. military is represented. We have a teachers'
19 group, someone who designs cutting-edge theme park rides,
20 libraries, museums, systems integrators, academic researchers,
21 and more.

22 What does this disparate group have in common?

1 Well, you can change the world. You represent the researchers
2 and engineers who can develop the hardware and software we are
3 going to need, the product and service producers, knowledge and
4 content developers. You are the early adopters of technology.
5 You are the groups that need to build bridges so technology
6 transfer can occur. You represent users of a wide range of
7 education and training end products and services.

8 To reach that, there is plenty to do. Technical
9 standards must be deployed to foster hardware and software
10 interoperability, hardware to hardware, hardware to software,
11 software to software, software to content, content to content.
12 For example, as one staffer put it thinking of medical training,
13 the knee bone has to connect to the thigh bone.

14 Our education and training institutions have to
15 build know-how and capacity for strategic technology management
16 and for managing massive organizational change. We need
17 innovative approaches and market strategies that will encourage
18 system integrators and other companies to take a risk and invest
19 in building new learning systems.

20 For example, in the *2020 Visions* report, we
21 incorporated a wide range of high-resolution displays in many of
22 those visions. Yet, U.S. companies are not yet fully engaged in

1 that particular business.

2 We are going to need a rich array of new content
3 while, of course, protecting the intellectual property of
4 content developers and ensuring efficient mechanisms to
5 compensate them for their work.

6 Teachers probably should have been mentioned
7 first, rather than fourth. Teachers need to be prepared for new
8 kinds of jobs and new kinds of roles, again, as the report
9 talked about, guiders through knowledge, rather than dispensers
10 of knowledge. There is a wide range of other issues: the need
11 for R&D investment, technology validation, scalability, privacy
12 as we talk about huge databases, and much more.

13 We are the Commerce Department here, not the
14 experts in providing education/training. We're not the
15 Education Department. But what Commerce does do is encourage
16 technological innovation. Indeed, the Commerce Department has a
17 unique charge in government of working with the private sector
18 to foster innovation and competitiveness.

19 For many years here at Commerce, we have promoted
20 new models for tech transfer, for R&D collaboration, for
21 public-private technology partnerships. We are sensitive to
22 markets and market forces, business investment, and risks.

1 We have served as a neutral ground for
2 stakeholders to come together and talk, public and private
3 groups, convening to explore new ways to collaborate. And
4 that's what our meeting is about today: finding new ways to
5 collaborate.

6 What I want to urge everybody here today to do is
7 to explore the new challenges; identify the priorities,
8 especially the next concrete steps that we can take; look at the
9 linchpins, try to figure out the choke points, the barriers that
10 are going to be in our way between us and the vision.

11 We also ask that you explore new processes or new
12 partnerships that might make more effective our nation's effort
13 to develop and deploy these emerging technologies into the
14 worlds of education and training.

15 This is, I think we can all agree, vitally
16 important. Simply put, Americans must have greater and more
17 effective access to the knowledge and skills development that
18 they personally need for the future. Technology promises to
19 enable that possibility.

20 We must tackle this challenge because America
21 must compete in global markets. We must do it to provide
22 American workers with a competitive advantage in a global labor

1 market force where many are willing to do the same thing for
2 less.

3 We must do it because rapid change means that
4 Americans will want and need, need, to be lifelong learners. We
5 must do it because there is enormous economic opportunity just
6 in providing all of the products that will surround this new
7 education and new training. Of course, the bottom line I think
8 that we can all agree on, we must do it so that every child can
9 develop his or her maximum potential.

10 So be creative, be inventive, rethink the
11 possibilities, and let's see if we can't make this the day that
12 people look back to and say, "That's when we began to change
13 American education and training."

14 Now, on to business and some of the logistics.
15 We're going to start this morning with a series of short
16 briefings to provide all of our participants with a common
17 baseline of knowledge on the scope of the issues that we are
18 going to try to cover today.

19 We are fortunate to have two stellar panels to
20 brief us. Let me introduce the first panel. Our first briefing
21 on the state of science and technology will be delivered by Dr.
22 John Bransford. He's centennial professor of psychology and

1 education and co-director of the Learning Technology Center at
2 Vanderbilt University.

3 Our second panelist briefing us on the state of
4 the industry and the markets is Karen Billings, vice president,
5 education division of the Software and Information Industry
6 Association.

7 Our third panelist, briefing on why we need
8 emerging technologies in education/training is William
9 Wiggernhorn, chief learning officer at the Cigna Corporation. He
10 also served as co-chair of the Commission on Technology and
11 Adult Learning convened by the National Governors Association
12 and the American Society for Training and Development.

13 Let me close by saying thank you again. We are
14 delighted to have each and every one of you here, especially
15 thankful to our panelists now, who are going to present. I will
16 ask John Bransford to begin.

17 (Applause.)

18 MR. BRANSFORD: Thanks. I hope you don't mind.
19 I think most of us are going to have to present from back here
20 just because the cord won't reach all the way up.

21 PANEL I

22 STATE OF SCIENCE AND TECHNOLOGY

1 MR. BRANSFORD: I want to give you a little bit
2 of perspective from the learning sciences. And I wanted to
3 start out with a challenge. Thanks to the Learning Federation,
4 it's a new view of what universities might look like, and we
5 need to meet this challenge, and high schools and others. And
6 it's by Father Guido Sarducci.

7 (Whereupon, a recording was played.)

8 MR. BRANSFORD: Well, that's it. I think this is
9 a good thing to think about for competition because if he goes
10 online, we're in trouble.

11 So the question is, how can we respond to this
12 kind of challenge? I think we all believe that that is what it
13 is, a challenge. I think we also all believe that in order for
14 it to help, we need it to go beyond that this is a cool factor.
15 So a big issue is, how can we do this?

16 So what I want to talk about is three legs to a
17 platform that we need to think about. One is information from
18 the learning sciences. One is information from technology. One
19 is information from change management and leadership. And
20 certainly business is going to be another one that is part of
21 change management and leadership.

22 If we don't have all three, if we are weak on

1 learning sciences, we are going to miss our success target. If
2 we are weak on change, we are going to miss our success target.

3 We need that balance, this three-legged stool, if you will.

4 For learning sciences, there is some good work
5 from the National Academy of Sciences on how people learn and a
6 very nice book on understanding by design. The technology one I
7 think the *2020 Visions* is a great example. It was phenomenal to
8 be able to read it over the Web before I came. Here is a good
9 example. Michael Fullan I really like in terms of leading in
10 the culture of change.

11 Let me just give you an example. I am going to
12 take this from post-secondary, rather than K-12. I want to just
13 give you an example of how technology can transform things --
14 this is part of an engineering research center we have that you
15 can see the people at the bottom that are all involved in it --
16 to use learning sciences and technology to change how
17 bioengineers are taught.

18 And so the transformation over -- we're into the
19 third year now -- was from great lectures but lectures -- this
20 is on biomechanics and learning to do the iron cross -- to very
21 technology-enhanced things.

22 And, just real briefly, we were able to collect a

1 lot of data. One is if you look at these course evaluations,
2 one is worse. To the right is good. And you see the red, as we
3 start to introduce technology organized around learning and
4 these things, you just see this whole shift to the right. I
5 won't go into detail on this, but that is very good.

6 The other thing is you start to look at we have
7 experimental control groups. Don't look at everything. Some
8 things are real easy for these students to learn. And so it
9 doesn't matter how you teach them, but look at the really
10 difficult things to learn, and you will suddenly see incredible
11 advantages. Part of knowing how to deal with technology is
12 knowing how to assess different things.

13 What I want to do now is go below the surface
14 because it's real easy to say this is a technology story, and I
15 really want to show that it is all three legs of that platform.

16 So one is let's take this little part of how
17 people learn. This is called the "how people learn" framework.

18 It's just four lenses for thinking about the design of any
19 learning environment, whether K-12, post-secondary, business, or
20 whatever.

21 The first part is you need to be
22 knowledge-centered. And that means you need to think about the

1 organization of knowledge. So let's go back, for example, to
2 Guido Sarducci and say, "Let's suppose we could reduce
3 forgetting everything you learn." Here's an example of proverbs
4 that we all know.

5 (Whereupon, a recording was played.)

6 MR. BRANSFORD: So you can say, "All right. Is
7 wisdom kind of memorizing a bunch of proverbs because certainly
8 for everyday knowledge they're useful?"

9 If you really get into knowledge organization and
10 what we know in learning sciences, no. You have to have your
11 knowledge conditionalized. You have to know the context of
12 applicability. It's very different from a list of facts.

13 So, look, I say too many cooks spoil the broth,
14 but many hands make light work. Haste makes waste. Wait a
15 minute. He who hesitates is lost. Nothing ventured, nothing
16 gained. Better safe than sorry. Absence makes the heart grow
17 fonder. Out of sight, out of mind.

18 These contradict each other. Where the wisdom is
19 in knowing there are times when too many cooks spoil the broth.

20 There are conditions under which many hands make light work.
21 And that's what you have to do to start to develop the expertise
22 necessary for success.

1 If I give you another example, if you teach
2 statistics, people can know how to compute z-tests, t-tests,
3 sign tests, et cetera, but it's knowing the nature of the data,
4 the nature of the problem that you're trying to solve and
5 knowing how to link that up with the right statistic that's
6 really the kind of expertise we need.

7 So when we think about the knowledge centers,
8 then, the first step is really to prioritize. What do we really
9 want our students to know and be able to do? And what aspects
10 of that give us an enduring understanding of a discipline, as
11 opposed to just a whole list of facts?

12 If you really follow this through, this is in
13 that biomechanics course I showed you. This is what Bob Roselli
14 did. He said, "Let's go beyond the taxonomy," which is the way
15 we typically teach. Here are our standards. Here is what we
16 want them to reach. But it's just an ordered list. Let's
17 prioritize it and set up a set of challenges going across the
18 top. Then any basic idea you have here is repeated a number of
19 times in the context of solving problems.

20 This may not make total sense, but I just want to
21 emphasize that the heavy lifting, a big part of the heavy
22 lifting, is figuring out how to organize a curriculum that helps

1 people develop the kind of expertise we want them to have.

2 So that's knowledge-centered. Very quickly
3 learner-centered. You can say students' reactions to baseline
4 teaching when we had biomechanics. If you got a three or a
5 little higher, that's pretty mundane. And you see, though,
6 there is a lot of variance there. These are a variety of
7 measures we won't worry about.

8 Now what happens if I start with some technology?

9 In this case, I can really see an iron ring demonstration. In
10 other cases in 2020, you see some wonderful visualizations.

11 I just start that, and then I start people to
12 generate ideas. What muscles do you think would be involved in
13 doing the iron ring? Now look what happens. This top line is
14 the engagement is improved quite dramatically. When I present
15 the challenge, it's much higher. Even if I give a little mini
16 lecture as a professor, I've created a time for telling. So
17 that is higher as well.

18 Then it's better yet if I have something like
19 this and I use -- this is a simulation that our Texas partners
20 developed. One of things it provides, a challenge provides a
21 focus for simulation. So it's focus work, rather than just "I'm
22 playing with a simulation" and, of course, the fact that you

1 could make it individual progress is learner-centered as well.

2 Community-centered. This is another part that is
3 very important in classrooms and involves helping the students
4 develop a sense of identity of what's it going to be like to be
5 a professional out there and how do I build a community where
6 it's safe to say, you know, I don't quite understand as well as
7 I would like to. That again sounds simple, but it's huge.

8 As you change the rules for students and get them
9 more into problem-solving and less into what they're used to,
10 which is computation and memorization, they need a constant
11 reminder of what is in the world.

12 So the sooner you can give them real and virtual
13 internship so they've got a sense of what it's like out there,
14 why they're learning what they're learning, we find that this is
15 very important for developing a sense of community.

16 Then I want to talk about assessment-centeredness
17 and, really, assessment-centeredness in the sense of formative
18 assessment; in other words, making students think as visible as
19 possible so I can help them if they're getting off track.

20 Here is a very simple technology that is actually
21 quite powerful, wireless response technology. A professor can
22 pose multiple choice questions.

1 Now you see them up there. The students
2 immediately see a graph. The responses are anonymous. And it's
3 a very powerful way to find out where your students are.

4 So here you can do it within a class. They've
5 got the challenge here. Their initial thoughts, gee, they are
6 all over the place. They don't really know which muscles are
7 the most important. Then I let them play with the simulation
8 for a while. And then I make sure I always have an assessment
9 phase in here.

10 This is the formative assessment phase. Here
11 they see a novice and notice where he's fine until right there.
12 And that's a break point. So if I've built a model, I should
13 be able to account for that.

14 And then I can do another assessment. Here I'm
15 still all over the place, even though kids tend to be better.
16 So now I can loop back, and it totally changes the nature of
17 lectures.

18 To go even further, our ISIS group with Larry
19 Howard has developed a whole course management system that lets
20 you go beyond just the classroom base and really tracks each
21 individual person.

22 The other thing is, though, you've got to assess

1 the right stuff. So let's suppose I have this. I want you to
2 learn to do free body diagrams. And I give you multiple choice,
3 and I say, "Which one of these is correct?" Well, in fact, kids
4 can get really good at that very fast, but that's not the skill
5 that they need.

6 What they need is to see this and generate a free
7 body diagram. What you've got to do is you have them do this.
8 You have them generate it. Then you show them the multiple
9 choice. Then you say, "Which ones are closest to what you
10 generated?" so there are all kinds of issues about generation
11 versus recognition here.

12 The other thing is summative assessments. So
13 that's what do we know at the end of a course. And here I won't
14 go into detail, but we found this very important to learn how to
15 create rubrics for precise windows on learning.

16 I showed you this earlier. If you can find the
17 places where students are really having trouble, that's where
18 you really want to focus. This is where technology can show
19 enhancement.

20 If you just try and sum over all of those, you
21 get so much variance you won't see any differences. And then
22 that allows you continuous improvement. So this is, in fact,

1 software we build to help because you notice that even the
2 students in the technology group weren't as good as they could
3 have been.

4 So, very briefly, this is the how people learn
5 framework. It's just four lenses. Look at the knowledge we
6 want them to teach. Look at how learner-centered we are, how
7 assessment-centered, and community-centered. Motivation
8 actually fits in all of those.

9 It is also important we use this for leadership.

10 So this is some of the leadership group in our bioengineering
11 center. And most ways of dealing with professionals, whether
12 it's professors or K-12 teachers, violates every part of the how
13 people learn framework because it's very fast little things.

14 Real quickly, new possibilities. This I think is
15 great. I really enjoyed it. There are a number of people here
16 who have done great applications who aren't necessarily in that
17 book.

18 One I just wanted to show that is one of my
19 favorites. Thank you, NSF, for just funding this. This is
20 teachable agents, which we think could transform video games.
21 So you really get to have a focus.

22 Then you go down and work with Betty, and you

1 draw a concept map and see if she can figure out what makes
2 rivers safe. She can talk and so forth. If you don't do it
3 right, she really messes up. It's very motivating, and it's
4 learning by teaching.

5 And then if you just prepared a teacher, that's
6 okay, but then you really need feedback from her so you can
7 change so you see better data there.

8 Another example is new opportunities for
9 assessment. All I want to say here is we are trapped in a mode
10 on assessment of what I will call sequestered problem-solving,
11 "Here is the test. Can you solve it?"

12 Any of us never work that way. We go into a new
13 environment. We have access to resources. The question is, can
14 we learn to solve a problem that someone gives us. We can use
15 computers to do that. That is a very different view of
16 assessment and transfer than we have had in the past.

17 This is just how we can start to design
18 environments. We're trying to do this. Down at the bottom are
19 a lot of granules. We have a lot of these out on the Web.

20 The big trick is how do we put them at a module
21 level so all of the components of the how people learn framework
22 are there. Those can be recombined into mosaics and courses.

1 This is the design principle that could be good. Then we have
2 actually got groups working on composable environments that let
3 these go.

4 So the guidelines I just want to leave you with
5 are, first, really getting a clear idea. What do we want
6 students to know and be able to do? That is changing a lot.
7 And it really should direct what we do.

8 Second is how people learn framework that is very
9 useful; third, these three legs that we need for success. And
10 then, fourth, we need this interoperability amongst our
11 technology applications so that we can all start sharing
12 resources and so forth.

13 So thank you very much.

14 (Applause.)

15 STATE OF THE INDUSTRY AND THE MARKETS

16 MS. BILLINGS: While I am getting help looking
17 through the presentation, I, first of all, wanted to say that
18 there are copies of the handouts. That way you can just listen,
19 as opposed to trying to take notes quickly.

20 The information that I think Dr. Bransford just
21 gave us is sort of a perfect setup into mine. Assume for at
22 least during my time period all of what John just talked about

1 wanting to emphasize content, particular marketization, the
2 assessment in the right way, those are all things that
3 publishers want to do.

4 They all know that based on how children learn
5 and what things they have learned about teaching and learning
6 and the whole process is what they really do want to do. My
7 role here today is to sort of talk about how difficult that is
8 to do, given the market, given what goes on in the classroom,
9 and given the state of our economy.

10 I am very, very pleased to be here today. I just
11 started with the software information industry. Being part of
12 the industry for many years, whether it be in textbook companies
13 or in software companies, platform companies, K-12 internet
14 start-up companies, I have been part of this industry. So a lot
15 of what I sort of speak to you about actually either comes from
16 personal experience or from this knowledge that I have gained
17 after 30 or more years.

18 The Software Information Industry Association is
19 a trade association for the software and digital content
20 industry. We have global services in government relations,
21 business development, corporate education, and intellectual
22 property, the number of the leading companies across the United

1 States and internationally.

2 Our mission is simply to promote and protect and
3 inform. To that extent, today what I am going to try and share
4 with you is from the education division those things that we can
5 do in a leadership position.

6 The education division plays a large role in the
7 draft and input and review of a lot of the recommendations,
8 legislation that comes through. The National Web-based
9 Education Commission was a very, very stalwart effort.

10 I think one of the things that you all have to
11 understand is that when folks in the D.C. area spend a great
12 deal of time putting together recommendations or putting
13 together a white paper or documents, school districts, higher
14 institutions, corporate training centers use that information.
15 It's great guidelines. And it helps them get budgets. It helps
16 them perhaps rationalize something that they want to do, but it
17 does support their efforts.

18 We work a lot with our member companies, key
19 federal officials, and national educational leaders. We try to
20 set up forums for discussion because we believe that
21 communication is incredibly important, just as it is here today.

22 We look at the opportunities and challenges of

1 each new legislation and laws. Right now the "No Child Left
2 Behind" Act is foremost in the minds of educators and publishers
3 and policy folks.

4 I just got back from a conference called EdNet,
5 which is primarily a conference for K-12 higher ed. corporate
6 training publishers, companies talking to other companies and
7 listening to educators, listening to other officials.

8 And probably every third session brought up
9 scientifically based research, no child left behind, or the rise
10 in accountability in both higher ed and corporate training, and
11 budgets. We'll get into that in a minute. But it was amazing
12 to me how quickly things have changed.

13 Their mindset is all of a sudden extremely felt
14 within the companies. Of course, they distribute, boiled or
15 distributed software and content and education. I think what we
16 say, software and content, most of the software has something to
17 do with content, either delivering it or bringing it directly
18 in.

19 One of the interesting things is that they depend
20 on the schools that they serve in many cases to develop a highly
21 skilled workforce. It's very difficult in a technology focused
22 company to do a lot without really highly skilled students from

1 universities or from other work centers who have come in.

2 Within K-12 education, I want to take just three
3 slides. It was very difficult to sum up what is going on in
4 K-12, higher ed, and corporate training in one slide each. I
5 put some sort of top-level things in my mind.

6 The things that are happening -- and this is very
7 recent. And, again, a lot of it comes out of recent data. Back
8 to school is a great time frame for getting a lot of this data.

9 It seems that we went through an era of
10 site-based purchasing, but it has moved to a little bit more
11 centralized now, either large districts and a lot of buying
12 consortia.

13 The schools, districts, buying consortia, state
14 education officials are very specifically asking for
15 instructional materials that address their core teaching and
16 learning needs. They are also because they have had enough
17 experience now with electronic media to want to have a
18 combination of print and electronic.

19 It's not one and it's not the other but a blend
20 where it's just depending on the learning needs of the student
21 that is the most appropriate. And they've had enough time using
22 both to understand that and make this use of each. And they

1 wanted to correlate to district and state curriculum standards
2 and to assessments.

3 I worked for a while for a company that actually
4 did correlation to standards and assessments. It's very
5 interesting. Six years ago and eight years ago, it was the
6 national standards that came out. Then states got on board.
7 And state by state by state until my last state, Iowa, had their
8 state standards. Then the large districts and medium-sized
9 districts came in and said, "No. Because of our learning
10 community, we want these things to happen."

11 That means publishers have to in order to sell
12 their products show the correlation of their content to the
13 state standards, the national standards, and sometimes the local
14 standards, which increases the cost of sales.

15 The purviewable expenditure on software is moving
16 up. Now, just compare that ten dollars to the five or six
17 thousand dollars a year that it really does cost to educate the
18 child. There's a lot that goes to a lot of other things besides
19 those instructional materials.

20 The after-hours classrooms are becoming more
21 important. Also, so is just the learning beyond the walls,
22 whether it's museums or charter schools or all kinds of things

1 are bringing into play.

2 There's a lot of mobility and portability
3 happening as kids are walking around with very portable devices
4 and a lot of the instant messaging. You walk through shopping
5 malls, as I did Saturday in Los Angeles, and these kids are just
6 instant messaging each other all the time. Well, you can
7 imagine the teacher is trying to give a test in a classroom
8 wondering who is doing some instant messaging at the moment.

9 The other thing is the strategic alliances. It
10 is very, very difficult right now for one software company or
11 for one content company to provide the kinds of total solution
12 that K-12 districts want. So they need to form alliances for
13 both development and distribution, particularly the curriculum
14 management.

15 In post-secondary or higher education -- and I'm
16 using them sort of simultaneously here -- one of the interesting
17 things is the degree to which online degrees are gaining
18 credibility and then also the blended approaches. Some of those
19 that are most successful -- I'm thinking now of places like
20 Pepperdine University, where they have some face-to-face and a
21 lot of online. It's sort of a blend again back to the print and
22 electronic that seems to work in the classroom that this works

1 best for educating, particularly for teachers.

2 There is a mix of institutional consumer sales,
3 the consumer sales, of course, to the students directly,
4 institutional sales to the classroom, the professors.

5 Now, the student population has been growing for
6 30 years. If there is a bright spot in the entire education
7 sector, K-12, higher ed, and corporate training, it seems to be
8 unanimously that of higher ed. So a lot of publishers who have
9 been in K-12 are looking for ways to sell their products into
10 the post-secondary market. Because of piracy, a lot of the
11 publishers have bundled their software with hardware or
12 textbooks so that it gets purchased legally.

13 There are some issues here with internet on
14 campuses. There is the 12-hour rule, which is penalizing some
15 online universities. In other words, they have to be 12 hours
16 of registered credits before they're going to get financial aid.

17 That's not what a lot of the online students are doing in
18 taking a course of a semester until they finally finish.

19 E-education vendors, the ones that seem to be
20 doing well and the ones that seem to be pushing and doing the
21 best, are those who are doing research and content databases,
22 course management systems, student information systems, the

1 hosting systems, a lot of infrastructure and e-enterprise
2 portals. Those are the ones who seem to have the brightest
3 outlook, at least, on what is happening.

4 In corporate training, there, again, the
5 per-employee expenditures can go anywhere in the pass for about
6 1,200, which is quite common, to about 4,000 dollars a year.
7 And I think the highest figure is at a place like Intel, which
8 has major corporate training initiatives.

9 However, 68 percent of that is now computer-based
10 and 24 percent is training online, which I was quite pleased to
11 hear. Now, the growth of corporate education is just a sort of
12 a slow, steady growth. Online delivery is going very quickly.
13 So what is happening is there is sort of a shifting of the
14 resources.

15 Generally, the publishers sell to the employers
16 with the exception of a place like the University of Phoenix,
17 where they're selling directly to students, and then some of
18 what we call the school derivatives, the Harvard business school
19 online and others.

20 The distribution channel is primarily direct,
21 again, to the employers of the companies. But direct sales
22 means you have a lot of salespeople, which is an increased cost

1 to publishers. The technologies there that seem to be
2 highlighted are the collaborative Web-streaming tools and Web
3 casts, again, because they can do training well that way. And
4 it's also very strong in government, particularly in military,
5 places transactional in nature, such as insurance, banking, and
6 medical concern.

7 Now, we had quite a few investors there. I
8 shouldn't say "quite a few." It was down to about ten percent
9 of what was there two years ago. But there were enough of them.

10 The few that are still interested in education had very similar
11 views. So I went ahead and edited that slide at the last
12 minute.

13 What they call the drivers of growth, in K-12,
14 with all the importance of accountability in education reform,
15 there's room for some new development. There's room for slide
16 development. There's room for the kinds of things they like to
17 see that grows the interest.

18 The post-secondary, because of the increased
19 recognition of benefits of education, so many people are out of
20 work, they're going back to school. That just creates the
21 market for them; then, again, the whole working adult student
22 market, be they enrolled in an institution, college or

1 university, or just doing sort of an e-learning courses one at a
2 time.

3 When they look at the investments -- and they're
4 doing just a very, very small fraction of what they did two
5 years ago -- they consider K-12 as the most diverse because
6 there's a lot of opportunity there. It's been a very strong
7 market and not as cyclical as other industries for quite some
8 time, but it's also risky for reasons we'll get into in a
9 second.

10 Post-secondary is, again, the market that they're
11 most willing to invest in because they see it continuing to
12 grow. Corporate training they see as the most relied on and
13 economic rebound. So they're very nervous. It's sort of
14 holding steady.

15 They haven't seen the drastic cuts as K-12, but
16 it is a place where companies to increase profitability can cut.

17 If you build a product and sell a product, you stay on your job
18 a little bit longer than if you're doing things like
19 professional development, I'm sorry to say.

20 Within the for-profit education industry, K-12,
21 and, again, corporate training is very slow because of budget
22 cuts, but the post-secondary providers are going strong.

1 Investors right now are very unwilling to inject
2 capital in education space because they see the budget cuts.
3 They consider K-12 and post-secondary risky because of
4 governmental regulations. So I think that is something we want
5 to keep in mind today.

6 Very quickly, that was from the investor's
7 viewpoint. From the publisher's viewpoint, there are many
8 challenges. I'll highlight those quickly. There's the training
9 in the rate of change. Publishers can build new products, but
10 educators have a hard time keeping up, going back to the
11 training, particularly with lack of teachers in general.

12 The policy environments keep changing quickly,
13 particularly the last one with HBR-1. Research and development
14 costs, good solutions take a long time to develop and a long
15 time to market them, particularly if the total solution, they
16 want to evaluate them for a year before they decide to purchase.

17 That's a long time to keep your company going. There are
18 greater systems requirements because of all the accountability;
19 again, the need for scientifically based research.

20 The restructured software distribution always, as
21 the technology keeps moving forward, that affects not just the
22 delivery but the whole infrastructure, its opportunity and

1 difficulty just in terms of keeping up. Copyright protection is
2 always an issue for them.

3 Their use of questions about what they can do in
4 the teaching, of course, online versus what they used to be able
5 to do in print, they got that after enough years, but it's hard
6 now with the fair use.

7 Again, I'll keep coming back to it. They want
8 total solutions, but they are difficult to evaluate and very
9 costly to purchase. The budgets are the most critical thing
10 that I heard people talking about. I've been in this business
11 for about 30 years, and I've never heard and seen so much
12 emphasis on the budget issues that they have.

13 Education institutions need a very sustained and
14 stable source of funding. And what's happening right now is
15 that with the state-level budget cuts and their own, they're
16 facing cuts that they never have before.

17 The technology budgets, on the other hand, are
18 relatively new. They are local expenditures. They're pretty
19 unique. And they're sort of a hybrid. So it's not been an easy
20 thing for school districts and/or universities to sort of keep
21 up with.

22 Again, at the institutional company level,

1 generally budgets are being cut, and it's affecting the
2 resources that the teachers, the educators, the training
3 professionals are being supplied with.

4 Our position at SIIA is that we do support any
5 long-term and comprehensive national educational workforce
6 development strategy. It's a must to make sure that the
7 citizens have the knowledge and skills to succeed in today's
8 global economy. And whether it's in K-12, post-secondary, or
9 corporate training, that's where they're going to gain some of
10 those skills.

11 We view the government's support and leadership
12 as very critical to this mission. And we know that technology
13 can address some of these needs, whether it's distance learning
14 opportunities, data-driven accountability, individualized
15 learning modules, and increased productivity and student
16 achievement. Those are the goals, and those are the things that
17 we hope we can and through working through together today.

18 Very quickly, the recommendations, very quickly
19 only because I lived these certain experiences, I have to bring
20 these in. There is federal funding to universities. For
21 example, University of Illinois almost 40 years ago -- I'm going
22 to say 40 years December because Plato Learning is having a

1 kickoff for their 40th year anniversary. Now, education
2 technology companies rarely have been in business for 40 years
3 and doing well. You know, they are a public company now.

4 It started in 1963 with Don Bitzer's teaching
5 machine and a grant to the University of Illinois. Now, just
6 that one grant has built this huge company. A lot of other
7 things are put into play, but there was seed funding that was
8 very, very important.

9 National Science Foundation funded workshops for
10 math teachers. This was exactly 1968. I know because I was one
11 of those math teachers. We learned programming, Fortran. We
12 tried and we did teach it to our eighth grade students.

13 Now, what I found interesting was that ten years
14 later, when I was entering teacher's college to get a doctorate
15 in technology and education, there were four people in my class
16 who had 15 years before gone through one of those National
17 Science Foundation workshops. That's how they got their start
18 in computing. It does make a difference. It creates leaders
19 for tomorrow.

20 There is federal funding to R&D firms. Right now
21 there are three or four little education companies that were
22 able to take the public domain local language and build a

1 business out of it. That started with development dollars at
2 BB&N and then on to M.I.T. media labs.

3 The other estate is capital, venture capitalists,
4 and a broker. Florida and Minnesota are just two of many, many
5 examples. Florida actually put in some dollars for an ESL
6 product development. At that point, nobody was doing English as
7 a second language. This was, again, about 12 years ago. And so
8 they used Dade County developers, Jostens. And together over a
9 couple of years, they produced some ESL software. It is still
10 part of the Jostens now Compass Learning product line.

11 Minnesota funded what they call the Minnesota
12 Education Computing Consortium to develop software for the brand
13 new Apple II's that were just coming out. They did that. They
14 got into Minnesota schools for free. Then they found that they
15 could license it to other schools.

16 So this consortium became a company, spun out of
17 the legislature, and then got bought by The Learning Company,
18 which was then bought by River Deep, also a public company.

19 All right. So our recommendations to you all --
20 and these come from not just myself or SIIA officially. I have
21 to tell you that being around about 200 education publishers the
22 last four days, these are the things that they kept asking for,

1 "If you can say something, Karen, say this" to make sure that
2 the publishers and customers are part of shaping innovative
3 solutions to provide customer resources somehow to create the
4 demand. And maybe it's through training, and maybe it's through
5 tax credits. They don't know. But something is there.

6 Speaking of tax credits, we have a number of
7 member companies who reside in Canada as their headquarters
8 because of the tax credits they get there. And they keep
9 asking, "Well, we'll move to the U.S. as soon as we get better
10 tax R&D incentives."

11 The trade opportunities. For a while,
12 international trade opportunities are very strong. Right now
13 they've cut back, but I think that can be built and I think it
14 could increase industry opportunities greatly.

15 Whatever we do with development dollars that the
16 Commerce Department is looking at, try to create what we call a
17 seed change. Those kinds of things we think could be or create
18 that seed change are full broadband deployment,
19 videoconferencing, particularly with a need for teachers,
20 wireless technologies, platforms to become personal, and a very
21 strong delivery infrastructure.

22 I just want to close by saying there are a couple

1 of resources there that we have. We did a trends report, which
2 is listed there. You can download that. It sort of talks about
3 anytime anywhere learning and is, again, the work of really
4 looking at that for quite some time.

5 There is a lot of market data in the report.
6 Again, I was a recipient of the *2020 Visions* last week. I think
7 it is wonderful, and I would recommend you taking that.

8 The very last slide shows the contact
9 information. I'll be here all day. Come back and talk to me.

10 Thank you.

11 (Applause.)

12 WHY WE NEED EMERGING TECHNOLOGIES IN

13 EDUCATION/TRAINING

14 MR. WIGGENHORN: My name is Bill Wiggenhorn.
15 Over the last I guess 40 years, incredibly 40 years, we have
16 been really talking about this particular topic. As a matter of
17 fact, when I read *2020*, I thought, you know, it's also very
18 similar to one that I read in 1980. And eventually we're going
19 to get there.

20 I bring that up because over the 40 years, I
21 spent 10 years at Xerox, 20 years at Motorola, about a year on
22 the West Coast with a group for kids, and now at Cigna.

1 Xerox, I was there kind of during the boom
2 period. Cigna is a company that sold George Washington a policy
3 in 1796. So it's been around a while, different names, but it's
4 been around a while. And the use of technology has a ways to
5 go.

6 So I've prepared kind of a paper. You can have
7 it if you want. It kind of gives all the big numbers, et
8 cetera. I thought I would try and speak to what I see as some
9 of the real issues that we face.

10 I thought I would actually present three papers.
11 One would be pre-9/11. The next one is post-9/11 but
12 pre-Enron. And the third one is post-Enron. I say that because
13 I can literally see a shift in mindset and investments during
14 those three particular phases.

15 Let's talk about just the impact on what we now
16 have to teach people that I really didn't have to teach prior to
17 9/11. After 9/11, all of a sudden, we had to teach safety to
18 every employee, no matter where they worked.

19 Safety included how to evacuate buildings. I am
20 on the 55th floor of a building, and I take it very, very
21 seriously because it's exactly 23 minutes if I am healthy from
22 my floor to the basement.

1 Now, online learning is probably not a good way
2 to try and figure all of this out. At some point you have to go
3 down 55 flights of stairs. But the whole plan, et cetera, of
4 doing that and moving 44,000 employees out of buildings into
5 buildings and safe areas, et cetera, has become a massive
6 education effort in beginning to look at technology as well as
7 just what we need to do.

8 So that was something that we didn't have to
9 worry about that much prior to 9/11. You had safety education,
10 of course, on those things where we dealt with chemicals or
11 something like that but not massive education for every single
12 employee on evacuation procedures, certain health procedures, et
13 cetera.

14 Now, thanks to some of our leadership in
15 industry, we now have eight areas of compliance education that
16 we must certify people in, eight areas, but I'm sure by the time
17 I'm out of here today, there will be nine.

18 As a matter of fact, some of these areas of
19 compliance education actually around policies, but when you
20 begin to peel it back will actually make it more difficult for
21 us to use technology to reach people because it's closing out
22 what we can actually share with our employees. So we will have

1 wonderful tubes but not a lot on them because the first thing
2 you learn is don't share a damn thing.

3 So I'm in a situation. I've just spent three
4 days with 185 nurses, which to me is a little terrifying, you
5 know, they shouldn't have access to the information. Good news.

6 I can tell you what was the therapy in 1985, but, regrettably,
7 I can't tell you today. I mean, one of the issues I think as we
8 look at these in the future is to look at all policies and
9 policies around security and policies around privacy and how
10 they impact, one way or the other, part of this learning process
11 because the policies we've referred to so far are very focused
12 on the education and community sector, but the policies
13 impacting me are not coming from that particular world.

14 After Enron, we now have ethics. Of course, it
15 has to be a special course because the audit committee now
16 requires that you teach people ethics. It's not good enough to
17 say you tried to imbed that in everything you did, but we now
18 have Ethics I, Ethics II, SEC Ethics, and Medical Ethics.

19 Now, if you think about it, from day one when you
20 come on board until we can put you in a job where you can be
21 productive, you have safety, compliance, and ethics.

22 And, of course, using technology and you want to

1 keep it cheap is the most boring presentation you have ever seen
2 in your life. Flip. Flip. Flip. And at the end, you say, "By
3 the way, we are going to use online learning. You're going to
4 enjoy it. It's going to be very exciting." The average age is
5 47. They're just praying they make it to 55 and get out of
6 this.

7 Now, I go through that because I think that these
8 are some of the very fundamental, gutsy things we have to deal
9 with. Another one we have just gone out on bid for a learning
10 management system, which is always high risk. I have already
11 bankrupt two companies since selecting these.

12 We have gone through them, and you say, "Why do
13 you need one?" Well, now I need one basically just to track all
14 of the compliance education. Now, I happen to be happy about
15 that because when I do my budget presentation, I basically show
16 visuals. Here is what is required, millions of dollars, and
17 here is your alternative. Here is what you will look like in a
18 federal prison uniform unless you are willing to do this because
19 now you really have to demonstrate that not only did you offer
20 it, but the person got it and now we're moving into assessing,
21 did they learn anything from it or was it the five-minute
22 wonder?

1 When we looked at the corporations, there were
2 210 of them that we found had LMSes. We put them through four
3 categories, which is required in business. One is like all
4 technical competency. And most pass that because they're great
5 technologists.

6 We're going to move ahead all of those years. I
7 mean, we love technology. We made stuff we like. We hope
8 somebody else will buy it. We would develop it, really, because
9 we enjoyed it when I look back on it. When people come and
10 present, you can tell it's those technologists really get it
11 well.

12 Then we have a business review process. The
13 business review is, will it actually work to do what we think it
14 should do? And do we have the discipline to drive it all the
15 way through?

16 One of the things that I have looked at in the
17 use of technology in business is that most of us stop short of
18 actually using it. We get so far, but we don't really look at
19 the total cost of the implementation of the system, not what we
20 pay the supplier but what is going to cost us to do it,
21 especially from talent resources.

22 The third one is relationship management. Do I

1 really want to deal with these? Will they be here tomorrow?

2 Now, what has been fun is that even during this bidding process,
3 they have changed. And these are preestablished organizations.

4 The last one is we put them through a financial
5 review. They came back and said, "Bill, I've got bad news for
6 you. None of them passed, zero."

7 I said, "Well, go back and forecast will they be
8 here in three years. I only need them for 36 months. Give me
9 that review."

10 Now there are some of the big players getting it,
11 like an IBM and Siebel and others. It's a different ball game.

12 But when you look at the ones walking through our front door,
13 that's what we're trying to develop as our supply base.

14 Now, in a sense, I have to form a coalition with
15 finance, with IT, et cetera. IT gets real excited and every
16 organization, "Wow. That's great. More stuff. We've got to
17 buy more servers." I mean, it's the first thing out of their
18 mouth. And we populate another server for them.

19 The second one is the learning people get kind of
20 excited. They're never going to use it, but they get real
21 excited about it because, after all, if I'm not in a classroom,
22 what am I going to do?

1 And then you have, really, the third is finance,
2 which keeps asking for return on investment. In my 40 years, I
3 have never really seen one per se other than what I call the
4 cost of ignorance. What did it cost us because people did not
5 know what to do? It was not embedded within that particular
6 workplace.

7 Now, when you look at the trend, and I say
8 post-Enron, it is a challenge to maintain a competitive
9 workforce. I would say pre-9/11, industry accepted a lot of
10 that responsibility. One of the things I worry about today is
11 post-Enron. Because we to do safety, because we have to do
12 compliance, because we have to do ethics across the board with
13 more coming down, I hear more and more from my colleagues -- and
14 I belong to several consortia; so I'm not just speaking from
15 Cigna -- saying that what is happening is I am going to educate
16 a few, and hopefully they will educate the rest. I don't
17 believe that will ever happen.

18 I've literally been in companies where 100,000
19 people say we want to pay 1,000 and we will invest that \$4,000
20 in 1,000. But it's up to them to educate the other 99,000. I
21 will guarantee you that won't happen.

22 So as we are trying to develop our strategies, I

1 said, "What would I, Bill Wiggenhorn, buy with my Visa or
2 American Express card to make sure I stay competent in this
3 ever-changing world?" because it's pretty clear that we're going
4 to need to have tools, new knowledge, et cetera, to keep being
5 employable.

6 Since none of us has a pension plan much anymore,
7 as my financial adviser said, you know, "It's good news. You
8 can retire, but you'll be 93." As we look within our own
9 organization, you see people not stepping out to retire.

10 Now, one is financial. The other one, though, is
11 more excitement about relearning, figuring out something to do.

12 So I think that, again, can be very exciting.

13 If I looked at the nurses I was just with for the
14 last three days, 185 of them, all were in their second or third
15 career. None of them were ever in a particular role they ever
16 expected to be in when they went to nursing school. And they
17 had to learn totally new skills and really enjoyed it. Most
18 planned to work until 60-70 years of age and as long as they're
19 competent in their skill sets will be able to do that.

20 Now, when we looked at the size of the labor
21 force, et cetera, those of us in the early boomers' age or late
22 boomers' age, et cetera, can stay around quite a while because

1 there is a shortage, as you all know, coming through the
2 pipeline. But it's also who is coming through the pipeline
3 because when I spent last summer visiting a lot of call centers
4 around the United States because if you look at call centers,
5 you realize that eventually they'll hire every single man,
6 woman, and child in the United States.

7 Instead of compulsory military service, you will
8 have compulsory service in a call center. And because most of
9 these call centers have anywhere from 30 to 200 percent
10 turnover, some of them never have to write the same payroll
11 check twice.

12 There are people, places but judged like they're
13 manufacturing centers. I mean, to me it's just kind of amazing
14 how we ever left manufacturing people into these people places.

15 When you look at them, you start to do profiles.
16 Some of them I looked at, one, 70 percent of the employees were
17 single parents. Two, it was the first job they ever had, ever
18 had. Third is 40 to 50 percent of them were the first member of
19 their family to ever receive any benefits. So what is a
20 benefit?

21 Another one was in certain parts of the country,
22 over 50 percent of them had English as their second or third

1 language, at best. And so you started to go through. When
2 somebody calls you and you can't understand them, the reason is
3 picked them up off the street shoved them in. Three minutes
4 later, you're alive with all this great technology.

5 But then you look at some of the technology you
6 had to work with. If you're in Pittsburgh, there is a call
7 center that deals with very sophisticated issues. It's not so
8 in the low end. This is dealing with very sophisticated things,
9 like heart transplants. Do you need a new heart? And it goes
10 through these 80 people there. They deal with 14 different
11 systems.

12 So, as you can imagine, on your screen you have
13 14 different systems you have to plug into to get the right
14 answer. I think that's a little different than the model that
15 you have. And the average age is 50. But they're learning, and
16 they will be able to keep up with it.

17 Now, at the other end, we have people who are
18 literally from a technology point of view illiterate. At
19 Motorola, we spent \$37 million teaching American citizens to
20 learn English and basic math, to get them to basically level
21 three. And then as we looked at those that keep coming in, as
22 the labor market got tighter, we still had to go back and redo

1 basic education.

2 Now with the labor market the way it is, you can
3 hire a doctorate to come in and do that work. You still don't
4 understand the person because it's a different end of the
5 spectrum.

6 But, anyway, there is that size. It's
7 understanding the diversity of the workforce. As a good
8 Midwesterner, when I worked on the West Coast, we had 11
9 definitions of what a family was. Even in my wildest
10 imagination, I only got to six. Okay? But the thing I learned
11 from that, all kidding aside, was the diversity and the blend
12 were very, very important. Again, how people learned was very,
13 very different.

14 Taking the principle of manufacturing, of
15 producing in lots of one in manufacturing to a certain sense,
16 and producing learning packages in lots of one for every
17 individual, if I really look at my organization today at 44,000
18 people in 80 major centers around the United States, they are
19 extremely diversified. They range from high school interns at
20 age 16 up through senior citizens in their mid 60s, multiple
21 language capabilities, multiple skill sets, from very basic to
22 extremely sophisticated. And one of our challenges is figuring

1 out how to keep them current but also within these tossed
2 parameters.

3 Another thing is I started to look at what it
4 cost us to teach English 101. If I can get someone to go
5 online, it's a couple of dollars. If I send them to community
6 college, it's \$200 to \$250. If I send them to a state-assisted
7 institution, it's \$500. If I send them to a private school,
8 it's \$1,100. If I send them to a private school or for-profit
9 school online, it's \$1,150. Where do you think we're going to
10 go?

11 Right now we have 5,800 people enrolled in
12 undergraduate and graduate programs, of which about 30 percent
13 are taking them online. The average course there is \$1,100. If
14 I give them the same course but I don't give them the degree and
15 I have the five-minute wonder, it's \$5 to \$10. We're looking at
16 changing our educational investment. If I say \$10 a course, I
17 can educate a lot more people than I can \$1,150 per course.

18 The other one is, instead of a degree, which is
19 great for the person because it helps you leave us and go get
20 another job -- one of the things I have researched is about 50
21 percent of the people who get an advanced degree funded by any
22 corporation leave within 12 months. So it's a very expensive

1 outplacement service.

2 So I've always said, "Send the people we don't
3 want for a Master's because it's a much cheaper way to get
4 revenue." As a matter of fact, if you send them to tier one
5 school, 75 percent of them leave you within one year. So it's
6 just like writing a check for your favorite charity.

7 So if you think about it, how do you refocus that
8 money? In our case, it's about \$7 million, but from \$10 to
9 \$1,150 for the same, thing. Now, there are things that are
10 worth paying \$1,150 for, but, again, we're starting to really
11 look at that.

12 Now, here are some of the issues I think that we
13 face. One is the IT structure within many companies simply
14 doesn't accommodate the exciting type of learning that we are
15 talking about here.

16 In our own case, it is really a page-turner. As
17 the nurses told me, "Bill, don't give me one more thing that you
18 tell me is Web-based or I'll kill you, and I am capable of doing
19 that" because what they were worried about is all of this
20 page-turning because we don't have the bandwidth. We don't have
21 some of the other investments to really push forward.

22 The second thing is that when I looking at

1 learning maps -- I'm sorry -- technology maps of IT
2 organizations, for the most part, they don't include learning as
3 one of their kind of constituencies and applications.

4 Now, why? Many times it's because we and the
5 education area have no one to speak to them. So we don't have
6 somebody with their language and we don't have anybody inside
7 there with our language.

8 So, to me, one of the positives that is coming
9 out of a lot of the instructional system design graduate schools
10 is young people with this language capability, but what you have
11 to do is put them in the IT department and begin to change, not
12 necessarily in the education department. So we are trying to
13 work through that.

14 Another one is the real estate people. I found
15 it interesting that the new coalition I want to work with is the
16 real estate people because, again, post-9/11 nobody wants to
17 build tall buildings. As a matter of fact, people would prefer
18 not to build any buildings and have you work out of your home.

19 And if you do, we'll have 5,000 people working
20 out of their homes by the end of 2003. We have 2,500 today,
21 professionals. What do I need to do to support that?

22 So in our coalition, it's IT, real estate,

1 learning. Then we have to have finance. Somebody's got to
2 figure out how to justify these investments.

3 Again, if I take it, if I can move a person out
4 of a cube and move them to their home, I can reduce my costs
5 from \$5,500 per employee in a cube to \$1,500 at home. That's
6 when I depreciate the technologies, furniture. That's
7 furniture, technology, lines, everything, over about a
8 three-year period. So then part of it is how do I provide the
9 learning for them on a 24 by 7?

10 Now, here comes the next issue: policies
11 regarding privacy, security. God forbid we would actually let
12 our people know what is going on. But, you see, it is a
13 government regulation. We can't tell them.

14 So when you start to peel it back again from
15 policy, it is the integration of policy I think that has become
16 so important. In the medical field right now or insurance
17 sector, there is this great thing called HIPA, which certainly
18 has some benefits. But it also has some very major restrictions
19 for us from a learning point of view in being able to get
20 information to people. So we have to battle through that.

21 The next one is having people who represent the
22 suppliers who actually understand the use. Very few who call on

1 us have really ever been on the other side and have to make this
2 stuff work. They're great on technology, lousy on application.

3 And so it comes down to that relationship management. Who can
4 you trust?

5 The last item is this whole cost issue. The
6 budgets are getting extremely tight. And the tighter the
7 budgets, with the more direction being provided of what it must
8 be invested in, it means there is less left over.

9 To me, that is what I come down to. What can
10 Bill Wiggenhorn buy with his Visa card? And how can I easily
11 get it? One of the things we have been thinking about with the
12 consortium that represents 2.7 million workers in the United
13 States and our total training budget is over \$2 billion is that
14 we will buy, first of all, jointly together.

15 Two, we will share all of our internal programs,
16 which we have done. So if General Motors designs a great
17 leadership program, all of us own the leadership program. If we
18 have a great program and ethics applies, all of us own that.
19 Just like a consortium of universities, we've all got a big ten
20 model and some of the others.

21 The other part of that was to figure out how to
22 get to buy so our employees could buy with their own money. So

1 maybe our job is we'll be the broker and we'll get the 30
2 percent discount, but we won't literally be the buyer with
3 corporate funds. The buyer will be with individual funds. And,
4 again, from a marketing point of view, it is how to get to them.

5 The last one is continue to look at some of the
6 legislative issues that we face. And it's more the integration
7 of policy, the seeing what the impact would be.

8 The last is at a conference in April, which was
9 basically on e-learning and that type of thing, the term
10 "blended learning" came forward. Now, the year before, in
11 Commerce, we would never use that term because we were excited
12 this technology was going to work. It was actually prior to
13 9/11.

14 Blended learning in my definition means we failed
15 in using the technology and we spent all the money, so we've got
16 to justify it to our bosses. So we say, "Great news. We have
17 blended learning. It's going to be much more effective."

18 That means in the classroom, we're going to put
19 computers, but we're still going to bring them all together.
20 We're still going to have somebody facilitating the learning
21 process. But we're going to have technology, wireless or what
22 have you, in there. We haven't figured out a way to certify our

1 own people on how to use the technology as part of that learning
2 process and to be the coaches.

3 Now, there are some very fine examples. I think
4 that is what we will talk about today, the examples. What I
5 want to bring across is that these are all pockets of
6 excellence, but, really, to me one of the challenges is how do
7 you get across American industry? How do you create a market so
8 that if you're in the software business, there literally is a
9 market for this.

10 The other one is we are always competing with a
11 15-year-old or the 11-year-old. I hired this summer 11 and
12 15-year-olds through grants given their schools because of child
13 labor laws, which is kind of an impediment to our progress.

14 It was very interesting what they did for me in
15 building a database for every educator within Cigna. They did
16 it for less than \$10,000. That's with all the pizza they could
17 eat, whatever they wanted.

18 Our internal systems group to do the same thing
19 is about \$120,000. We went out on bid to a boutique firm
20 because then it doesn't count as head count, still cash, was
21 over \$120,000.

22 And so what I have been lobbying for here for

1 years is to change the child labor laws to let us get those
2 little suckers about age four and grow them. But, all kidding
3 aside, they are very comfortable with it, as you all know, when
4 they come in our doors today at age 18 or so.

5 And the only reason I try to bring them in is to
6 embarrass the rest of us into action because they look at our
7 technology and say, "How? I have never seen anything so
8 primitive?"

9 We're just going to XP. When I came on board, we
10 had Windows '95. I literally thought my staff had set me up. I
11 said, "Oh, this must be a joke."

12 They said, "No. This is state-of-the-art." Now
13 we're finally going to XP. One of the things we are doing in
14 going to XP is we are hiring young people to coach our
15 leadership on how to use the technology.

16 And we're trying to recruit as many sons and
17 daughters as possible because we know they are smart and pay
18 them \$10 an hour because, again, what I have found -- and this
19 goes back to using the technology learning process -- is we
20 usually don't implement fully.

21 We really don't understand it. And we never
22 really assess it. What we do is pray we're gone before the

1 assessment becomes due and let the other person deal with it.

2 So thank you very much.

3 (Applause.)

4 MODERATOR BOND: Thank you, Bill. My
5 eight-year-old will be sending a resume.

6 Let's move quickly to our second panel, also
7 really superb folks who have joined us here to talk about
8 emerging technologies that really could revolutionize this
9 space. We will get views from industry, government, and the
10 university research community.

11 So let me welcome Irving Wadawsky-Berger, vice
12 president for technology and strategy at IBM Enterprise Systems
13 Group. He has also served, by the way, as co-chair of the
14 President's Information Technology Advisory Committee.

15 He will be followed by Ralph Chatham, program
16 director, training superiority for the Defense Advanced Research
17 Projects Agency. Everybody knows DARPA, Mr. Chatham
18 particularly knowledgeable about some of the most advanced
19 education and training technologies emerging today.

20 And then third and last on this panel, Dr. Ulrich
21 Neumann, director of Integrated Media Systems Center at the
22 University of Southern California, where they are doing some

1 exciting and creative technology development. He is also one of
2 the authors of the *Visions* report, *2020 Visions*.

3 So, Irving, please.

4 PANEL II

5 EMERGING TECHNOLOGIES - INDUSTRY VIEW

6 MR. WLADAWSKY-BERGER: Good morning. Buenos
7 dias. ?Como esta usted? Mui bien. Just checking that I
8 haven't forgotten my Spanish.

9 While Washington clearly does not want for issues
10 great and small, few have greater implications for the long-term
11 health of our economy and society than the nexus between
12 information technology and education.

13 In IT, we have the emerging infrastructure that
14 will underlie all of our institutions well into the Twenty-First
15 Century. But, even more important, our ability to thrive in an
16 increasingly competitive world is an educated skill,
17 well-trained citizenry.

18 Let me begin by offering kudos to both the
19 Commerce and Education Departments for their superb publication,
20 *2020 Visions*. Later in my remarks, I will talk about the
21 promise of IT, but, frankly, Commerce Secretary Evans
22 articulated it so well in his letter accompanying the *2020*

1 Visions document that I would like to borrow his words, and I
2 quote, "Powerful new technologies now under development by U.S.
3 businesses, universities, and government promise to transform
4 virtually every industry, create rich and compelling learning
5 opportunities that meet all learners' needs and provide
6 knowledge and training when and where it is needed while
7 boosting the productivity of learning and lowering its costs."

8 We have applied IT to science and, in the
9 process, we've mapped the human genome, took business and
10 transformed it to e-business. And we have developed the most
11 wonderful infrastructure to better conduct scientific research
12 and accelerated the breadth and pace of discovery. That's what
13 the internet has done for scientific research.

14 Our progress in applying IT to advanced learning
15 and training has been nowhere near as successful. Let me quote
16 what Secretary Paige, Secretary of Education Paige, says in his
17 introductory letter to the 2020 Visions document, "Education is
18 the only business still debating the usefulness of technology.
19 Schools remain unchanged for the most part, despite numerous
20 reforms and increased investments in computers and networks."

21 I am not overstating the case when I say that the
22 knowledge and skills of our people are the main support of our

1 national security, the firm foundation of our democracy, and the
2 strong engine of our economy. But, yet, we have not provided
3 our teachers with enough of the IT tools or research into their
4 effective use that we have given to so many other disciplines
5 and practitioners. That is the grave national challenge. And
6 that is the one that we all need to address.

7 Let me talk about technology. Had this meeting
8 been convened 20 years ago, our goal would probably have been no
9 more ambitious than getting primitive PCs out of the school lab
10 and into classrooms.

11 Today the technological potential is absolutely
12 stunning. Microprocessor storage, memory bandwidth, and all
13 sorts of other information technologies are improving year in
14 and year out by 50, 60, even 70 percent, becoming powerful and
15 inexpensive, tiny and potentially ubiquitous, like all those
16 electric motors in our homes and cars.

17 Soon we will be building systems of what we call
18 blades; that is, servers that are roughly one-inch thick and
19 very small. We will cluster those blades into systems first by
20 the thousands and not long after that by the hundreds of
21 thousands.

22 Even a 1,000-blade system of today is like

1 putting the power of 36,000 1990s PCs into a size roughly
2 equivalent to a walk-in closet. This is very nice for the
3 users. It totally creates havoc with the vendors, but that's
4 life. The systems will all be collaborating and sold in the
5 most sophisticated problems and supporting hundreds of millions
6 of users.

7 A trillion calculations per second, what we call
8 a teraflop, used to be a big deal. But now hundreds of
9 trillions, hundreds of teraflops, are around the corner and just
10 beyond that, a quadrillion calculations per second, what we call
11 a petaflop.

12 Now let me put it into context. It has been
13 estimated that the human brain calculates at around ten
14 petaflops. I have no idea if it is true, but that is what some
15 estimates have done. We should be reaching that ten-petaflop
16 level in roughly 10 to 15 years at the present rate of
17 innovation.

18 Apart from the real power, what makes today's
19 technology different is the rapidly growing prevalence of open
20 standards. Information technology today is approaching the kind
21 of standardization that has made electricity an integral part of
22 society.

1 As a result, we are beginning to realize the kind
2 of flexibility that will allow IT to be integrated and managed
3 smoothly that will make it commonplace and boring, just like
4 electricity.

5 The internet showed us the power of open
6 standards. When the research community introduced a set of open
7 protocols that enabled systems to communicate and unveil the
8 prospects of near universal connectivity.

9 Now, tens of millions of new users connect to the
10 internet every year. We are well on our way to a billion people
11 online around the world. So technology is proliferating,
12 growing in performance, and declimbing in price. And open
13 standards emerging allow us to integrate.

14 So what is next? What is the next major stage in
15 the evolution of technology? Actually, the research community
16 is already in the process of taking the internet beyond its role
17 as a transport network and as a great communications and content
18 platform and making it a distributed computing platform. That
19 emerging phenomenon is called great computing.

20 Just like the internet let us share content,
21 great computing will let us share the actual computing
22 resources, process source and storage applications and files,

1 memory and data, all of it. And will those enable networks of
2 computer and the people who use them to work with one another
3 and solve common problems?

4 If you have the proper authorization to access a
5 grid, you could really be sitting at a terminal in a poor school
6 in Brooklyn accessing a database in Bombay and processing it on
7 a supercomputer in Berlin. It doesn't matter where the resource
8 is. It might as well be under your desk.

9 Now, as you would expect, research communities
10 around the world are moving ahead on grids. In the U.S., the
11 NSF's TeraGrid, which Ruzena Bajcsy had so much to do in
12 launching, will connect powerful high-performance computers at
13 four locations, University of Illinois, NCSA, University of San
14 Diego Supercomputing Center, and Cal Tech and Argonne National
15 Lab, and provide about 14 teraflops of computing power, roughly
16 700 terabytes of storage, all connected with 40, 4-0,
17 gigabit-per-second bandwidth. Now, that is serious bandwidth.

18 Thousands of scientists around the U.S. will use
19 its computing resources in search of breakthroughs in life
20 sciences, climate modeling, and other disciplines.

21 At the University of Pennsylvania, the national
22 distributed mammographic archives are bringing advanced methods

1 of breast cancer diagnosis and screening to patients across the
2 nation.

3 That grid, which is heavily supported by NIH,
4 connects teaching hospitals at University of Pennsylvania,
5 University of Chicago, and North Carolina, and Women's Hospital
6 in Toronto. It has been designed to serve thousands of
7 hospitals over time and to provide physicians with analytical
8 tools to diagnose individual patients and identify cancer
9 clusters in the population.

10 Authorized medical personnel will have near
11 instantaneous access to patient records. And the need for
12 expensive film X-rays will decline. Once loaded into the
13 system, a patient's mammograms will be evaluated, regardless of
14 where they were done, by incredibly powerful super computers,
15 the kind I have talked about before, so they can quickly isolate
16 abnormalities by comparing current mammograms with those from
17 previous years.

18 What this many grids being built in this country
19 and around the world have in common is very strong government
20 support so that we can develop better science engineering and
21 medical applications. This should surprise no one. After all,
22 the more advanced nations of the world tend to support their

1 scientific and technical communities.

2 In that regard, the U.S. has no equal. As we all
3 know, the internet itself was developed by the Department of
4 Defense. Applying technology to science and engineering has
5 paid off handsomely for this country, which leads us to ask why
6 we haven't applied it to the same extent to learning and
7 training.

8 Now we can all say it's politics. We can all say
9 a lot of things. But sometimes when asking a question like
10 that, it is helpful to wield Ochiem's razor and pursue the
11 simplest answer.

12 The fact is that education is hard, really,
13 really hard, harder even than cosmology. I sometimes think that
14 we know more about distant galaxies than about the ways little
15 children learn. By comparison, galaxies are really simple.

16 With the right math, the right equations, a few
17 computers here and there, you can come up to reliable
18 conclusions. People, on the other hand, are very complex.
19 Education, which follows how people are, is, thus, equally
20 complex. And it involves a broad matrix of factors, some
21 quantifiable, many not quantifiable. It receives complete
22 objectivity.

1 Now, some may ask whether given the complexity of
2 education it is destined to lag, no matter how much information
3 technology we apply. But our experience suggests otherwise.
4 IBM, for example, has had a reinventing education program to
5 apply technology and reengineer the teaching process. And it
6 has involved a commitment of 70 million in technology, talent,
7 and cash. And it has so far reached 65,000 teachers and 6
8 million children in K-12 across the U.S. and 9 other countries.

9 An independent study concluded that students
10 whose teachers were involved in the IBM program made significant
11 academic gains in grades 7 through 11 across all academic
12 subjects, the largest gains being among students at the bottom.

13 Those gains have continued long after our financial support
14 ended.

15 In the corporate world, as we heard, online
16 training allows employees to stay engaged in productive
17 activities. For example, Sony Corporation's European operations
18 used to send employees away to a number of business schools for
19 training. For almost the same price that purchased ten days of
20 classroom-based training, Sony can now give its managers 12 to
21 15 weeks of virtual training.

22 In Mexico, Monterey Tech, which is one of the

1 most advanced schools in the use of technology, uses e-learning
2 to reach 24 campuses all over Mexico and 80,000 students.

3 There is plenty of other empirical evidence that
4 IT can extend the reach in benefits of education across a broad
5 spectrum from the classroom to the platform, but we must begin
6 to apply technology far more aggressively than in the past. And
7 we should begin with a well-funded national research initiative
8 on IT in education.

9 Not surprisingly, when we make a serious
10 investment in research, good things happen. Whether it's
11 physics, IT, biology, or medicine, well-funded research programs
12 attract top researchers. They then attract students to the
13 field. Usually they result in innovations that no one could
14 have predicted.

15 Our investments in education research have not
16 nearly kept pace with those in the sciences. We need a major
17 well-funded research program in the use of IT in education with
18 all key federal agencies participating, one that will build on
19 the Department of Commerce expertise in innovation and
20 technology.

21 I think our country also needs a national
22 education infrastructure. The foundation is growing right

1 before our eyes in the form of our emerging grid-based research
2 infrastructure. We can take the research grids we are building
3 and start extending to all university education departments and
4 teachers' colleges, integrating them into the research
5 infrastructure and eventually drawing every school in the
6 country into a nationwide community.

7 Now, what are some of the benefits this could
8 give to us? Most experts believe that personalized instruction
9 is productive instruction. In the PTHACH report on transforming
10 education through technology that we published in February of
11 2001, one of the most interesting things that is there is the
12 fact that it has been estimated that with personalized
13 instruction, you can move how kids do by about two sigma. That
14 is, somebody in the 50th percentile will move to the 98th
15 percentile if they have a personal tutor.

16 Unfortunately, we cannot afford a tutor for each
17 child, but with the grid-based education infrastructure and the
18 right tools, we can let a teacher approach that tutorial
19 environment while decreasing the cost of personalization.

20 To fully exploit that potential, teachers must be
21 really well-trained in the use of the technology, but most
22 states have neither the resources nor the technical ability to

1 mount comprehensive development programs of their own.

2 And research shows repeatedly that schools of
3 education continue to be disengaged from classroom-based
4 learning in the school districts they serve. Deploying such a
5 grid-based national education infrastructure could be a resource
6 for the states and teachers' colleges and provide highly
7 sophisticated teaching tools, like simulations for
8 discovery-based learning, some of which are so well-articulated
9 in the papers and the *2020 Visions* document.

10 Clearly, this will all require a huge amount of
11 work that will have to be the focus of a major national research
12 effort. We need federal investment in infrastructure, clearly.

13 Just as important, it has to be accompanied by a huge emphasis
14 on how to use the equipment productively, including training the
15 teachers to use simulations, games, and all sorts of new
16 computer-aided techniques.

17 We have to resolve that we will begin treating
18 the teaching profession as well as we have treated our
19 scientists and engineers by investing in the sort of
20 infrastructure that will support the thriving, vital, productive
21 national teaching community.

22 Trained, competent, and committed teachers are

1 our only assurance that new generations of Americans will be
2 sufficiently skilled and intelligent to keep our economy strong
3 and our society stable and our future really secure.

4 Muchas gracias.

5 (Applause.)

6 EMERGING TECHNOLOGIES - GOVERNMENT VIEW

7 MR. CHATHAM: Hi. I am Ralph Chatham. I have to
8 apologize that my vision statement is not in your fine document.

9 I am still going through the DOD clearance process. So I can
10 send it to anybody I want as long as it's not for public
11 release. I am going to start with a training technique which is
12 a story to set context.

13 Imagine ten years from now in the ready room of
14 an aircraft carrier, dimly lit theatre-like compartment, not
15 much different than this place except it's rolling, and the
16 aircraft on that carrier aren't much different than they are
17 today. The electronics is a little different, the weapons
18 inside, but they look the same. But the people are different.

19 A bored duty pilot is sitting inside the ready
20 room. You have to do this sort of thing. And, instead of
21 playing the equivalent of Doom, she checks into DARWARS. This
22 is not a real program yet. This is part of the clearance issue.

1 But I have to say it is a program that consists of about 70
2 proposals, white papers, sitting on my desk at the moment.

3 I also should caveat that I am talking to you
4 under three hats. One is DARPA. One is the Defense Science
5 Board, for which I ran a couple of training task forces.
6 "Training Superiority and Training Surprise" is a good seller.
7 Look it up. It's a fun read, I'm told. I'm prejudiced. The
8 third hat is me, and that is who is talking right now.

9 Okay. The bored pilot prints the DARWARs. It
10 looks at her and says, "I know who you are. You didn't read
11 your last after-action report." And it says, "Here it is. Read
12 your last after-action report." The external domain expertise
13 is busy at the same time collecting information about what
14 happened to F-18's in the last couple of weeks.

15 The pilot, as he is reading the last after-action
16 report, he says, "Wait a minute. You haven't read paragraph
17 three. I was tracking your eyes. I know. You didn't like
18 paragraph three. Your eyes moved. What's wrong?"

19 So she types in what's wrong. This does what the
20 Microsoft paperclip, my apologies to the Microsoft people here,
21 can't do. It says, "I don't understand you. You don't
22 understand me." Shall we send a note off to the Navy equivalent

1 of the training and doctrine command and see if we can
2 adjudicate this?

3 So the note gets sent off. And then the system
4 sends a message off to DARWARS Central saying, "This pilot wants
5 to train."

6 Well, the DARWARS Central gets that message and
7 then looks down here and looks at the Senate to ask decisions,
8 "Which war are we going to check this pilot into? What kind of
9 things do I need? Who else is out there playing in this war?
10 What does this pilot really need?" We will see what happens.

11 Well, there are a lot of other things that might
12 be out there in the world. Each one of those blue boxes
13 represents a box similar to the one here with a pilot, the local
14 records, the ancient Macintosh because that is what came out of
15 the clip art, the eyeball looking back at her, and the joystick.

16 Whatever is available, it has got to be the stuff that is
17 around at the time.

18 Well, it looks around, the DARWARS says, and I've
19 got this person out at Fort Hood who is practicing his tactical
20 pashtu and in also being a forward observer. That's what that
21 gentleman thinks he's doing. Well, there's going to be more to
22 it in a moment. Let's see what happens here if I push this

1 button.

2 We look around. We say, "All right. You need
3 some move forces, some avatars, extra people." Boy, have I got
4 a war for you. By the way, it asks, "Do you have any friends?"

5 "Oh, right," she says.

6 She calls around, wakes up a few people. A
7 couple who aren't too angry said, "Sure. I'd like to
8 participate." They're sitting in their stateroom with their
9 PCs. They connect via local network, but that's only three.
10 And the tactical unit is four. So we'll import an AVATAR,
11 either locally or from DARWARS Central there. And they set you
12 up, and you start to fly, flying, as it were, on the PC.

13 The scenarios are generated, either locally or
14 otherwise. You get up there. You tank. Well, it turns out
15 that one of the pilots needs some experience in tanking. The
16 other two don't.

17 So the two of them are sent off on a navigation
18 expedition or exercise. And the other guy tanks. Not one of
19 them know that they have been separated. When that is all done,
20 you find out that you cut time.

21 You're now over the don't spend four areas
22 waiting to get over the area that you want to fly in. You're

1 now over Afghanistan in this particular case. You have talked
2 to the AWACs aircraft, which Navy people don't get much
3 experience practicing. This may be a real AWACs or an AVATAR of
4 an AWACs.

5 Now, what happens here is the system says, you
6 know, this guy down at Fort Hood, he hasn't had his last dose of
7 point of wound care military medicine in the last six months.
8 That's one of those things you've got to just nail into the
9 midbrain of somebody in order that they don't forget it.

10 So it turns up the screws of the gain on the war.

11 So that this guy quickly calls one of the pilots down. The
12 pilot hears his urgency and breaks his hard deck, comes flying
13 down there, and scrapes the cavalry charge of the evil bad guys,
14 whomever they may be.

15 Now, this actually happened, up to this point.
16 Somebody did break his rules, went down straight. And he got
17 away with it.

18 In this case, we need a victim for this guy to
19 practice his point of wound care. So we'll shoot him down with
20 a shoulder-mounted surface-to-air missile. And if the pilot
21 doesn't do that, sticks to his rules, well, we'll shoot General
22 Gostum instead, the guy he has been talking to, whatever we need

1 to get the training as it needs to be done.

2 And then you generate after-action reviews. The
3 after-action reviews are used to improve DARWARs over here.
4 They're to improve the expertise domain. They're generated
5 locally with the help of the individuals. Perhaps one of the
6 pilots, the one who was shot down, goes back to his stateroom or
7 is sitting in a stateroom and is fuming about having been shot
8 down.

9 So he sits down, and he writes himself a new
10 piece of software. He sends off to the expertise domain area,
11 which makes sure that Obi Wan Kinobi sits on his shoulders and
12 tells the next guy in that position not to go below his hard
13 deck.

14 So I am not above any cheap trick to try to sell
15 my program. When I was trying to sell it, this is my cheap
16 trick. I played the Star Wars fanfare on a pair of sneakers I
17 had hidden under my boss' desk when he didn't know it and blared
18 it out when I got to the point where I was talking about DARWARs
19 Tetherquest. His name is Tony Tether, and he may recognize
20 Tetherquest.

21 This is a pause here. What prompts me with that
22 story? Why am I doing this? Well, it is an observation that we

1 don't have enough wars. We have a training superiority that is
2 remarkable.

3 Read my report. This is advertising the DARPA
4 report on training superiority and training surprise. It is an
5 invention that was created by the Navy and then taken whole hog
6 by the Army. The Air Force scraped the navy blue paint off of
7 it and took it after about three or four years of hiding from
8 it.

9 It involves creating a war in a virtual world.
10 Virtual in this case is a large instrumented range. You have a
11 better than real enemy. The enemy are people who are stationed
12 there. Their only job is to be a good enemy.

13 And they are graded by a different chain of
14 command than the guys whose units are being trained. You then
15 practice in this environment. And you come back. Because it is
16 instrumented, everybody knows what happened.

17 It's not the first guy to the blackboard wins.
18 It's this is what happened. What did you see? What were you
19 thinking? Why did you do that? And pretty soon the people
20 themselves say, "What was I thinking? What did I see? Why did
21 I do that?" If you don't *mea culpa* enough, they will *youa*
22 *culpa*.

1 Then you go back, and you do it again. In the
2 case of the Navy, it changed their air-to-air exchange ratio
3 over Vietnam in one year from 2:1 to 12:1. The Air Force hung
4 in at 2:1 for the rest of the war, flying essentially the same
5 airplanes. If I didn't give a B-52 bomber tailgunner credit, I
6 wouldn't have gotten that far.

7 We do this in pieces of our forces, some units
8 every few years. So what I want to do is make this ubiquitously
9 available to move, as my office director says, from a standing
10 military at peace to a peaceful military continuously at war, a
11 persistent war anyone can check into at any echelon units or
12 individuals, fighting common conflicts, delivering on-demand
13 skills, and things that the combat training centers can't train
14 and where they can't train. Now, again, the bottom line there
15 is this is not yet funded. It is in the solicitation stage.

16 I am going to go back here because there is
17 another observation. There are two observations I wanted to
18 throw at you. There is an unintended human consequence of this
19 technology and this transformation that is being poured into the
20 military, much of it from DARPA, and the technology weenies, of
21 which I have been one, so I am allowed to say that, don't
22 understand that human consequence. And that is that the very

1 junior people in our hierarchy are going to have to think.
2 There is nothing in their background that has trained them to do
3 that.

4 I have this vision of this junior soldier
5 standing in the middle of the field at night separated from
6 everybody that we know, all the mechanisms we know, that make
7 people fight in tight situations, which is the buddies next to
8 them.

9 There they are standing there, 90 pounds of
10 electronics on the back, being forced to do something cognitive.

11 The bits and bytes are falling faster than the bullet. Again,
12 apologies to Microsoft, all will miss that paperclip.

13 And it won't work. Schoolhouse training won't
14 work. Distance learning as it's constituted now won't work.
15 It's necessary but not sufficient. We need to have training
16 right there when it's needed and often enough and compelling
17 enough that people will continue to use it.

18 What it won't do, what my idea of the ubiquitous
19 training with the hardware that is available to people today or
20 tomorrow -- that's PCs. If we can get them to work, whatever.
21 Whatever is there. It won't be the highest fidelity.

22 If you are a military guy, I say if you get a

1 DTEV5, I'm going throw you out. I don't need one metered
2 resolution for every place. That is going to waste all of that
3 bandwidth that we won't have on our shifts.

4 It's not psychophysical motor skills training.
5 It won't train a dismounted infantry how to climb walls, how to
6 walk through thick grass, but it will tell them what to look
7 for, what to think about when they have to climb a wall or walk
8 over lava rocks.

9 It won't teach that guy at point of wound care
10 how to stick the needle in and what it feels like to stick the
11 needle but when to do it and, equally important, when not to do
12 it. It won't replace the combat training centers or the field
13 exercises or basic recruit training, but it will train things
14 that they can't do or it will make it so that when you go to the
15 combat training center, you are better prepared for it.

16 And it won't eliminate all schoolhouses. So this
17 is a caveat for our friends in TRADOC who have a strong vested
18 interest in schoolhouses.

19 Why I think it might be doable, well, the first
20 is we have enough computing to do this kind of stuff. We have
21 enough networking if we are careful about how we use the
22 bandwidth. There is a whole military simulation infrastructure

1 who thinks that they're in the business of training and they're
2 not. They're in the business of simulation.

3 All of the stuff in DARPA and elsewhere that has
4 been called training has really been thin veneer training pasted
5 over a wonderful computer exercise.

6 I am on the other side. I am a lone voice in the
7 wilderness of my technical weenies in my office. So stay tuned
8 to see whether I get anywhere. That's another reason why that
9 paper wasn't approved.

10 The massive multi-player online games. There is
11 a huge user buy-in to these things. If you're not aware of it,
12 you should look into it.

13 Everquest has more than 400,000 subscribers
14 paying \$10 a month or so to be in a game. The average user is
15 there more than 20 hours a week. A third of them are in the
16 virtual world more hours a week than they are at work.

17 And not only do they have that kind of buy-in,
18 but they build teams. They spontaneously form teams. They work
19 together. They talk to each other on cell phones, on Web sites,
20 on whatever they can, and not only that, but there are people
21 who sit down and write software for their virtual world.
22 They're apparently with a legal decision that the Florida zoning

1 regulations do not apply in the virtual world. It's that much
2 compelling contributions.

3 Now, who better to write training ware than the
4 people who are doing the work? If I can get them to do that, as
5 in my picture, that is the user buy-in piece of that.

6 I want this, that computer, to have at least one
7 more adjunct that looks back at me and increases the bandwidth
8 in the way that tutors look at people. As I am lecturing to
9 you, I can see some of you are sleeping and some of you are
10 awake. If I were tutoring you, I would be taking specific
11 action to wake those up who are kind of nodding. And I don't
12 blame you.

13 There are all kinds of buzz words, standard
14 ontologies, reusable things. And, oh, yes, there is another
15 observation that I am trying to beat, which is that the builders
16 of our weapons hardware, the people who have the bucks in the
17 Pentagon, ignore training in their design. Sometimes it's
18 tacitly. Sometimes it's intentionally. But they expect that
19 the training will pay the bills after their hardware has
20 developed for all the mistakes they have made.

21 Somehow or other, we are going to get people to
22 use them. And the training system is going to have to fix that.

1 And they kind of expect that to happen. I hope that DARWARS
2 has a chance of handling that.

3 So now I am going to read you a concluding
4 statement here because I think I am at the point of concluding.

5 Our current training superiority is based on creating a
6 training war and practicing within it. There are neither time
7 nor resources to do this continuously in the field, but it may
8 now be possible to practice the cognitive aspects of warfare
9 continuously on demand at all levels in a virtual world.

10 In doing so, the program that I hope will get
11 started and, thereby, allow me to publish this thing, DARWARS,
12 may move us from an episodically trained standing military in
13 peace to a peaceful military continuously at war in a virtual
14 world.

15 Our transformed military will, thus, be superbly
16 ready to perform whatever mission is required of it because
17 every member in every unit will have practiced and wrung out
18 many changes on the mission theme in that training world.

19 Mark Twain wrote in "Life in the Mississippi"
20 that being a riverboat pilot stood him in good stead as an
21 author because every personality type he subsequently
22 encountered, he already knew, "I met him on the river."

1 Well, in the same way, this new training vision
2 might make our forces able to meet the unexpected challenges of
3 future conflicts. We will have fought them before in DARWARS.

4 Thanks.

5 (Applause.)

6 EMERGING TECHNOLOGIES - UNIVERSITY RESEARCH VIEW

7 MR. NEUMANN: Hi. My name is Ulrich Neumann. I
8 am the director of the Integrated Media Systems Center at
9 University of Southern California in Los Angeles.

10 We are an ERC, which means we are an
11 NSF-sponsored engineering research center. We do work in
12 multimedia, internet technologies. This image here was created,
13 actually, as the cover image for our piece that is in the 2020
14 *Visions*.

15 A benefit of being maybe the last speaker here is
16 that I can point to several things in here that occurred in the
17 prior speeches and prior talks.

18 A few of the things here, for people who can't
19 see it, are this notion that people are distributed, that the
20 concept of the classroom wall starts to fade as you apply the
21 technology.

22 So we have people shown here joining a virtual

1 class from several parts of the country. What is really
2 something I want to bring together here is that we heard of the
3 benefits of real time simulation-based learning,
4 experience-based learning.

5 And that is part of this image, to bring these
6 people together. Those are the kinds of activities that future
7 students in these types of classrooms will be engaged in, their
8 multimedia experiences. They are engaging. They are like
9 gaming.

10 And the reason why people spend all of that time
11 in Everquest is not because anyone is twisting their arm or
12 forcing them to do it as homework. They like it. We are
13 pleasure-driven people. Children, in particular, have to be
14 engaged. And that is part of the problem.

15 Putting a book on a CD-ROM is not engaging. And
16 that's where we have failed in the past. And that is where we
17 will continue to fail until we recognize the fact that this has
18 to be an experience that people want to have.

19 Another point I want to make here is that this is
20 expensive. We heard a little bit about this earlier. This is
21 expensive. A way to amortize the expense of doing that is to do
22 it on a large scale, nationally. National archives of useful

1 education modules are a way to overcome the problem.

2 Just like your local playhouse in the small town
3 may not be able to do a full-scale production, a theatre
4 production, of a play or story, Hollywood can because they are
5 doing it for a worldwide audience.

6 So we need to approach that type of thinking, of
7 producing things on a very large scale that may be very
8 expensive to do, but we are going to use it over and over and
9 over again in thousands, maybe millions of classrooms. That's
10 another point.

11 The third point about this is really this
12 one-on-one tutoring. This is something, again, the CD-ROM or
13 the textbook overlooks. The experience of reading from a
14 screen, from a textbook, from really anything that is passive
15 that does not provide a human form of interaction is boring and
16 is limited.

17 Our attention span on these sorts of things has
18 to be recognized to be a limiting factor in terms of how much we
19 are going to get out of it. We probably have a few-minute time
20 span where we can focus our attention on something like that and
21 we can expect our kids to focus their attention on things like
22 that before they need to be engaged, prompted, perhaps plotted,

1 perhaps directed.

2 Somehow interaction has to be part of this. Part
3 of interaction, of course, is assessment. The reason one on one
4 is so effective is because the tutor is continuously assessing.

5 He is not waiting until the exam three weeks after he teaches
6 something. He is doing it right there, prompting with a small
7 question.

8 The appropriate question at the appropriate time
9 indicates whether the material has been mastered. So we try to
10 put all of that in there without putting a caption, but
11 basically those are the ideas in this image. So if you don't
12 see them, they are really there. Okay.

13 Please, now we'll go on to the slides. I really
14 only want to make a few points here. I didn't prepare a long
15 talk. As a faculty, I'm such an engineering faculty I have to
16 use formulas.

17 So opportunity is research, commerce, and need.
18 Really, if you put those three things together, we have this
19 opportunity to harness advances, advances and investments to
20 address the future of education.

21 Of course, the research I'm talking about is the
22 research that's been done and funded by DARPA, National Science

1 Foundation, corporations, and universities all around the
2 country to really produce this internet and computing technology
3 base that we have. This is infrastructure that we can bring to
4 bear on this problem.

5 Commerce, of course, we have Moore's law working
6 for us here, which means that technology gets ever higher in
7 capability and ever cheaper and smaller in terms of physically
8 what it is, what the embodiment is.

9 So we have very high-quality components and
10 systems, and they're becoming very low-cost. The need, of
11 course, is simply that we need to have an engaged workforce that
12 is competitive in a world economic system.

13 Next, please. So, again, I want to focus on this
14 national resource. I am not sure anyone knew what was happening
15 as the internet got rolled out, but the fact is it is now here.

16 It is coming into our homes in the form of broadband.

17 And, as we move forward, that broadband
18 connection is going to get better and better. Our ability to
19 compress the things we want to send down that connection will
20 get better and better, which means we are getting two benefits.

21 We can squeeze more content into fewer bits. And we can get
22 more bits into the home all working in our favor. And we are

1 going to take advantage of this nationally to make use of this
2 resource.

3 The way it is going to unroll as a visionary, we
4 can say it is peer to peer. The way we currently look at the
5 internet and use e-mail to send text from any one person to any
6 one or many other people, we are going to start doing that with
7 real-time media. That means that we will be sharing video, we
8 will be sharing sounds, touch through haptic interactive
9 devices, not just text but also 3D models, simulations, all of
10 this going over the internet from any one place to any other
11 place on demand.

12 Think about a Thanksgiving dinner. This is an
13 example I use. Think about what a Thanksgiving dinner at your
14 home would be if you could just punch up your relatives in other
15 cities in the country and join them for Thanksgiving dinner,
16 audiovisual, complete high-fidelity teleconferencing, if you
17 would, between you. Why wouldn't you do that? Why wouldn't
18 that be a compelling experience?

19 Really, in the education context, that is part of
20 that breaking down the walls that I mentioned earlier, the
21 ability for each student, whether they are home, whether they
22 are in the classroom, to engage with other students in study

1 sessions, for example. They don't need to go to the library.
2 When you're 8, 10, 12 years old, you are not necessarily able to
3 do that anymore that easily, so being able to do it from your
4 home where your computer is a very big advantage.

5 Another point I want to make here is presence is
6 something we have overlooked in a lot of the technologies to
7 date. Presence is what makes it engaging. When you are looking
8 at a book on a CD-ROM, there is no notion of a presence there.
9 There is no notion that there is a live person in that screen or
10 any type of intelligence in that screen that is interacting with
11 you.

12 So putting some intelligence into it, whether it
13 is real or simulated, whether it is a real person at the end of
14 a teleconferencing system or simulated AI intelligence in the
15 education module, is a very important thing.

16 In order to get presence, I think we have to look
17 at a way to do this, which is something we call immersion.
18 Immersion is this notion that you were there. Presence is a
19 personal thing. Immersion is a more general thing. We can be
20 immersed in information as we work from information that sits on
21 our desk.

22 We don't even need electronics to get that.

1 Immersion electronically is all about getting people, serving
2 the needs of people, and getting that information into our
3 heads. Okay?

4 And so technology really needs to work in a way
5 that serves our needs. It's about matching technology with the
6 way we work and producing these engaging and effective learning
7 experiences.

8 There is an observation here I want to make,
9 which is that we look at Moore's law, on one hand, creating
10 wonderful technology, ever-increasing technology, for us, but it
11 also becomes an enemy if we get to a certain point. I think we
12 are starting to see that now. We start getting bombarded with
13 information.

14 Moore's law gives us more and more devices, more
15 and more information coming at us. And we have to digest it.
16 If we think about the rate at which this is happening, it is
17 going to become more and more of a problem.

18 And so being able to distill that information
19 into something that is comprehensible and that suits our needs
20 is an ever-increasing problem. And that is part of this
21 education problem as well because students really have to have
22 well-digested information, not a lot of disparate facts that are

1 just sprinkled around on a screen.

2 Finally, just it's really also more than the
3 component. We can develop wonderful technologies. We can
4 understand the way humans work. But it's putting all of this
5 together and rethinking the way we do classrooms. It is not
6 about taking last year's lesson plan and putting it into
7 electronic form and just sending it over the internet.

8 It is going to be a lot of testing, a lot of
9 stumbling, a lot of trying things out, a lot of research. That
10 has been part of the theme here, too, to fund some types of
11 larger research initiatives to understand how to do education
12 with this electronics. We just don't understand that very well
13 yet.

14 Lastly, again, National Science Foundation is
15 funding the work we are doing. Our project has been underway
16 for about three-four years now. I would invite you to look at
17 our Web site to get some more information.

18 Thank you.

19 (Applause.)

20 MODERATOR BOND: Thank you. And thank you to all
21 of our panelists. This is a stunning development, a
22 government-run effort that is on schedule. This is really

1 amazing. Thank you again to our panelists. Thank you again to
2 all of you for being here today. Many of you I know traveled to
3 brave weather and protestors and everything else to be here. We
4 appreciate that.

5 We are going to move to our panel discussions
6 now. But before I do that, I also wanted to say just publicly a
7 special word of thanks to the Office of Technology Policy staff
8 here that has put this together, a special thanks to Carol Ann
9 Meares and John Sargent over here many of you have worked with
10 in the build-up to this. They have been the real energy behind
11 it.

12 (Applause.)

13 MODERATOR BOND: I need to say thanks to our
14 partners at the Department of Education and at the NSF, a number
15 of participants from those two organizations here today as well.

16 Okay. Now that our panelists have enlightened us
17 and given us a baseline to share, we are going to go into two
18 breakout sessions. One breakout session will be addressing R&D.

19 It will be led by Irving, whom we have heard from, and Henry
20 Kelly from the president of the Federation of American
21 Scientists.

22 The R&D breakout group will meet down the hall

1 this way. It will be on the left-hand side of the hall as you
2 go down. It is room 4813, Technology Demonstration Center.

3 Another breakout session on non-R&D policy and
4 innovation issues will be meeting in this room. It will be led
5 by Gary Bachula, the vice president of external affairs for
6 internet2 and a former deputy under secretary for technology,
7 and by our own Bruce Mehlman, assistant secretary for technology
8 policy, who directs the OTP staff we just thanked. Again, they
9 are going to be right here in this room.

10 Each of you has been assigned to a breakout
11 group. You have got a list I think that you picked up earlier.

12 If you really believe you could best contribute in the other
13 group, please see John or Carol Ann, and we will try to get that
14 effected.

15 Now, again breaking precedent with government
16 programs, we will be working right through lunch, through breaks
17 and everything else. You will have sandwiches and other forms
18 of nourishment showing up in the hallways outside around noon or
19 so. And you can wander, as you will, to get a little bit of
20 food and keep going. We will come back here at 1:30 to be
21 briefed on the discussions in the two groups and move toward
22 wrap-up.

1 So thank you. And let's try to stay on schedule.
2 (Whereupon, at 11:02 a.m., the foregoing matter
3 was adjourned.)